

Treatment for Radioactive Elemental Mercury Wastes

Perma-Fix Environmental Services, Inc.

Presented by:

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Treatment for Radioactive Elemental Mercury Wastes

- First to be on-line with commercial treatment of liquid radioactive elemental mercury
 - Timeline:
 - 2001: Technology licensed to Perma-Fix
 - Jan 2002: Equipment received @ Perma-Fix M&EC facility located in Oak Ridge, TN
 - March 2002: System installed and proof tested
 - May 2002: First waste scheduled to be processed

Treatment for Radioactive Elemental Mercury Wastes

■ Regulatory Basis

- Mercury is designated as one of the '53 Persistent, Bioaccumulative, and Toxic (PBT) chemicals found in the hazardous wastes regulated under RCRA.'
- Waste Minimization National Plan, USEPA 1994:
 - Reduction of PBT chemicals in RCRA hazardous wastes 10% by 2000, and 50% by 2005 (1991 baseline);
 - Avoid transfer of RCRA PBT chemicals across environmental media;
 - EPA seeks to improve the treatment of mercury-bearing wastes to further reduce air emissions, the mobility of mercury species at the time of disposal, and the potential for future biological or chemical conversion to other mobile & bioaccumulative species of mercury.
- Mercury is one of the most significant risks based upon long-term human health and environmental assessment for air emission sources (DSSI BIF & DOE TSCA incinerator, commercial retorters).

Treatment for Radioactive Elemental Mercury Wastes

■ Regulatory Basis

- Radioactive elemental Hg subject to technology treatment standard of **AMALG** (amalgamation). **NO NUMERICAL STANDARD FOR THE PERFORMANCE OF RADIOACTIVE AMALGAMATED MERCURY!!!!**
- 268.42 Table 1 identifies amalgamation technology based standard as:
 - Amalgamation of liquid, elemental mercury contaminated with radioactive materials utilizing inorganic reagents such as copper, zinc, nickel, gold and sulfur that result in a non liquid, semi-solid amalgam and thereby reducing potential emissions of elemental mercury vapors to the air.

Treatment for Radioactive Elemental Mercury Wastes

Perma-Fix M&EC Facility

Located at the department of Energy's East Tennessee Technology Park (ETTP)

- Began operation in April 2001
- Designed and built in support of the U.S. DOE's Broad Spectrum contract.
- Licensed and permitted to treat a wide variety of mixed waste including inorganic, organics, liquid and solids, PCBs, Mercury and contaminated waste waters.



Treatment for Radioactive Elemental Mercury Wastes

ADA's amalgamation process is only one of two EPA Approved processes

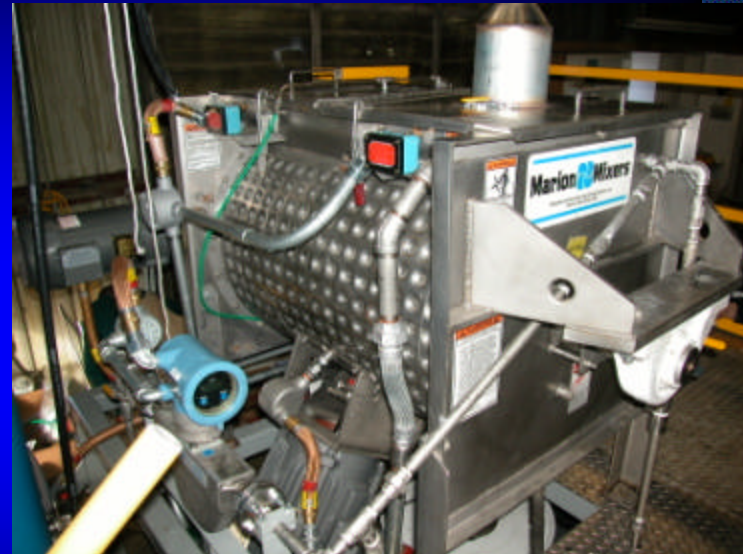
- Exothermic process:
 - water
 - sulfur
 - elemental mercury
 - liquid sulfur compound
- 10 ft³ capacity unit



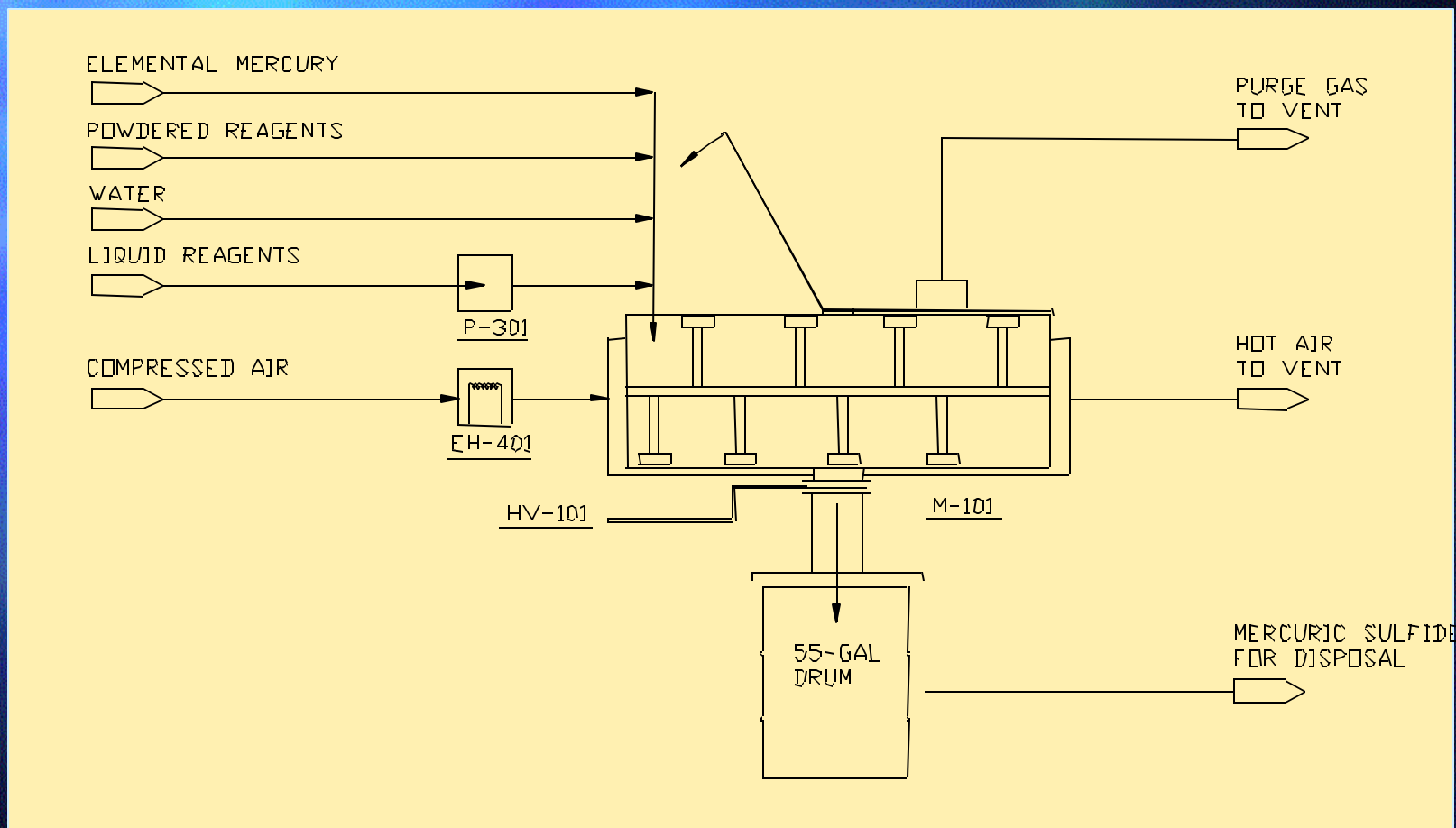
Treatment for Radioactive Elemental Mercury Wastes

ADA's amalgamation process is only one of two EPA Approved processes (*continued*)

- Mixing/Blending Unit
 - batch mixing mode
 - chopper bladesEnsures the waste receives the maximum amount of surface area contact with treatment chemical
- Maintain temperature around 190 °F
 - air flow controls



Treatment for Radioactive Elemental Mercury Wastes



Process is Based on ADA Patent; Meeting Treatment Goals is "Art"



Operation
produces a free-
flowing product



(Avg. Diam. 3/8")

Perma-Fix Environmental Services, Inc. - Capabilities

The most Comprehensive mixed waste treatment capabilities in the U.S.

- Each of our facilities offers a variety of treatment processes
- Timely, compliant treatment (each facility operates under its own Rad Material License and RCRA Part B permit)
- Years of experience treating hazardous constituents

Perma-Fix Environmental Services, Inc. - Capabilities

Perma-Fix of Florida

Located in Gainesville, FL.

- Operated since 1983, has treated > 35, 000 ft³ of MW
- Licensed for bulking and other pre-treatment of mixed waste
- Licensed and permitted to treat a variety of characteristic and listed mixed wastes, soils, liquids, sludges, and debris to Land Disposal Restrictions (LDR) standards.



Perma-Fix Environmental Services, Inc. - Capabilities

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Perma-Fix Environmental Services, Inc. - Capabilities

Perma-Fix/DSSI Facility

Located in Kingston, TN

- Employs high temperature (a licensed industrial boiler) to ensure that the contaminants in the waste are destroyed or bound to meet LDR criteria.
- Operated since 1991, has treated >7,000,000 lbs. of radioactive and mixed waste.



Perma-Fix Environmental Services, Inc. - Capabilities

Pretreatment or separation processes:

- Perma-Fix II
- Chemical Extraction
- Aqueous Waste Treatment
- Dewatering & Filtration
- Chemical Fixation
- Metals Precipitation
- Neutralization
- Alkaline chlorination
- Controlled Water Reaction
- Liquefaction

Perma-Fix Environmental Services, Inc. - Capabilities

Final Treatment Methods:

- Stabilization/Solidification
- Combustion
- Macroencapsulation
- Direct chemical oxidation
- PCB Treatment
- Mercury Treatment